

## Article

# Reengineered Governance Process for Assessing Core Public Infrastructure Projects

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**Abstract:** Although the global financial crisis has adversely affected finances, governments continue to prepare substantial budgets annually to promote major economic development projects. However, the projects that are actually implemented by the current system often encounter delays, low public usage after completion, or failure to achieve the original objectives or expected benefits. This issue demands that the government immediately establish the countermeasures needed for effective improvement. The objective of this study is to provide a mechanism for promptly terminating ineffective projects and for minimizing the risks of ineffective project execution and unused budgets. To achieve the goal of the efficient use of financial resources, this study applied a qualitative research method and the process of reengineering concepts to provide government agencies with standard operating procedures and to review checklists for project assessment. The analysis results can be applied to public infrastructure projects before or during execution and provide an exemplary urban policy evaluation model for a three-tier administration system. The contributions of this study aim to reduce the misuse and waste of national resources and to maximize the efficiency of resource use by developing a standard review procedure, effective assessment procedures, a checklist, and a review checklist that can serve as a reference for government agencies.

**Keywords:** economic development; urban planning; public performance; regulations; administrative governance reform; infrastructure evaluation



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## 1. Introduction

Efficacy in promoting the major economic development projects of a country not only reflects the efficacy of domestic construction, the administration, and infrastructure development, it also indicates the overall competitive advantage of a country. It is also crucial for improving the social economy, creating employment opportunities, enhancing the quality of life, and elevating national competitiveness [1,2]. Since 1953, when the first phase of the Taiwan economic development project in relation to land use was implemented, the government has continually promoted various economic development projects and major administrative initiatives to improve the public domain, foster the development of domestic industries, and accelerate economic growth. Public demand for major public infrastructure projects such as transportation infrastructure, environmental sanitation infrastructure, cultural and educational facilities, major tourism and recreational facilities, and sports facilities, has increased concurrently.

In 1989, the Executive Yuan (the highest public services administration institute), Taiwan, began promoting a mid- to long-term project system to meet the growing need for public construction. However, the actual implementation of the mid- to long-term projects was often delayed or suspended. Additionally, the completed facilities and the infrastructure were often underused. The failure to achieve the original objectives and

benefits resulted in increased community skepticism. The key reason for the failure was the lack of a comprehensive analysis of the financial, technical, human-resource, and operational management relevant to the project during the planning stage [3,4]. This deficiency resulted in the failure to reject inappropriate projects and the inability to perform timely reviews and revision plans during project implementation. A means of forceful withdrawal is also needed for plans that should not be implemented.

Therefore, this study focused on mid- to long-term case projects included in major urban development plans and established stringent and objective assessment criteria and dimensions for various project stages: (a) project conceptualization, (b) feasibility analysis, and (c) integrated planning. These objective assessment criteria and dimensions were used for the proactive rejection of projects that did not meet initiation standards. An early warning assessment process and supporting methods were also proposed during the implementation stage to screen active projects for potential termination. Moreover, standard operating procedures (SOPs) for amending and terminating projects were established, and a complete management mechanism was developed for initiating and withdrawing projects.

In particular, the SOPs were used as a reference for the establishment of an information monitoring and early warning system, which is expected to effectively help reduce the misuse and waste of national resources and maximize the efficiency of resource use [5,6]. Government process reengineering (GPR) and e-government are mutually reinforcing, and GPR allows the government to use modern information technology to improve the efficiency of government affairs [7]. Finally, major urban development plans can achieve the purpose of sustainable use, and policy management methods can be widely applied to various types of plans to achieve sustainable management and economic development.

The remaining sections of this study are as follows. Section 2 reviews the domestic and foreign assessment mechanisms for initiating and withdrawing projects and reviews the literature on organizational process reengineering. Section 3 introduces the qualitative research methods applied in the literature and in this study. Sections 4 and 5 describe the initiation and withdrawal of the SOPs and reevaluate the public construction operating procedures established in this study. Section 6 gives the conclusion, recommendations, and contributions.

## 2. Literature Review

### 2.1. Assessment Mechanism for Domestic Public Construction

A proposal for mid- to long-term projects must be assessed by various government agencies before approval. However, the approval of ineffective or unfeasible projects continues. Public projects have a reputation for being slow, costly, and anachronistic with newer private project delivery systems that may be more innovative and cost effective [8]. Feasibility assessments for public construction are often ineffective because they do not adequately evaluate the results and effects of the projects [9]. This problem must be immediately resolved.

Currently, the procedures used by the various agencies of the Executive Yuan for controlling and evaluating mid- to long-term projects are mainly based on Article 15 of the compilation and review guidelines for mid- to long-term projects. Mid- to long-term projects should be included in annual administrative plans and annual performance reviews. When necessary, the projects should be revised or withdrawn. Pursuant to the guidelines, the control and evaluation of the administrative plans are regulated at three levels: the Yuan, the ministries, and the local agency.

After several years of refinement, Chao [10] developed a complete model for project management and the procedures needed for controlling and operating administrative plans. The model comprises regulatory management options, determining operating projects, tracking project implementation, on-site verifications, project adjustments and withdrawals, and project examination and assessment [10]. However, despite the use of procedural models for controlling and evaluating project implementation, project delays are common. Most delays are attributable to improper execution and the use of an improper control and

evaluation method. A major problem when assessing the control and evaluation of mid- to long-term public construction projects is the inability to execute public construction projects effectively within the scheduled time frame [9]. This indicates that the current laws and regulations for promptly initiating the reevaluation of ineffective projects are insufficient.

Meanwhile, Article 15 comprises the compilation and review guidelines that mandate the examination and assessment of mid- to long-term projects and that are used by the various agencies of the Executive Yuan. The article requires an evaluation of the effectiveness of the implementation of mid- to long-term projects after their completion. The main objective of the project examination and assessment is the review of the effectiveness of the implementation of various tasks by using a specific examination and assessment process to determine whether the project achieved its stated objectives and whether the performance of the project was satisfactory. Project examination and assessment are used to decide whether an extended project should continue or should be improved [11].

These guidelines seemingly provide a complete set of methods and norms for project examination and assessment. In practice, however, ineffective project operations are common [12]. Excessive regulatory items can complicate project examination and assessment and obtain provisions that do not accurately reflect actual operations [13]. Reviews of major public construction projects differ from those of regulatory agencies and obtaining timely feedback from regulatory bodies for reference during the project review may become difficult. The difficulty of using annual administrative plans to examine and assess the overall operational benefits of mid- to long-term projects also increases. In a specific major public construction project, Liu et al. [14] compared the key indicators of green building (US, UK, Canada, Japan, Taiwan) and green civil infrastructure (Taiwan) assessment systems. They indicated that greenery, the recycling of materials, water conservation, carbon emission reduction, and energy saving should be considered in both green building and green civil infrastructure assessment systems. Some items (e.g., durability, benefits, landscape, humanities, culture, and creativity) are concerned only with green civil infrastructure assessment, but not in green building assessment.

Relevant norms must be established for public construction projects because of their substantial investment requirements, high risks, and widely varying characteristics and functions. The critical success factors for infrastructure projects should be explored and the project performance must be measured during the service period of projects. Therefore, a system is needed to analyze all stages, including the feasibility study, integrated planning (to periodically engage in land acquisition reviews), environmental impact analysis, and construction implementation assessment. Moreover, various operations require rigorous supervision during the project implementation to ensure that the project meets all planned objectives [15].

## *2.2. Examples of Systems and Practices Used in Other Countries*

Case studies can help both public and private sectors learn lessons, strengthen the importance of positive factors, and thus increase the attractiveness of project procurement. Similar studies can also be conducted to discover the current status of project procurement in other countries [16]. This study analyzed the public construction systems that are used in the United Kingdom and Japan [17,18]. Both countries show that their systems are basically divided into a pre-project assessment, a during-project (reevaluation) assessment, and a post-project assessment [19]. In Taiwan, major public construction projects require a pre-project assessment, which includes project conceptualization, feasibility studies, and integrated planning [20]; however, the during-project assessment is performed when the project is actually implemented. This study used the pre-project and during-project assessment practices in other countries as references for developing similar practices for the Taiwan construction industry.

### 2.2.1. Pre-Project Assessment

- (a) **Policy assessments for public construction projects and administrative plans** For the pre-project assessment, the British government requires assessments of all public policies, plans, and projects in accordance with The Green Book [21]. Conversely, the Japanese government requires that all projects be assessed using the norms formulated by the central government regardless of whether the projects are proposed by the central or local government [22]. Specifically, implementation effectiveness must be periodically reviewed.
- (b) **Diversified Assessment Indicators** The compilation and review mechanisms for British and Japanese infrastructure projects not only emphasize the economic benefits, they also clearly articulate the relevant concepts and assessment indicators for the financial benefits, land acquisition, safety, environmental impact, policy needs, and other unquantifiable dimensions. For example, for public construction projects, the British and Japanese governments have stipulated social discount rates of 3.5% and 4%, respectively, in the financial assessment index.
- (c) **Unified conceptual norms** The Green Book and the Japanese public enterprise evaluation guidelines establish the norms and general guidelines for regulating the issues that policy assessments must evaluate. Detailed norms can be formulated according to the needs of the relevant departments. The Taiwan government could use the same mechanism to formulate detailed assessment methods, which would then provide a reference for standard operations.

### 2.2.2. During-Project Assessment: Implementation Stage

- (a) **Sustainable policy assessments and feedback mechanisms** Both the British and Japanese assessment mechanisms include feedback mechanisms for the repeated monitoring and review of the effectiveness of the implementation of a project from the decision-making stage to the project completion stage [17,18,22]. Notably, reviews of changes in project conditions and environment, risks, uncertainties, and target deviations are required for projects that are already in the implementation stage.
- (b) **Develop check points and a termination mechanism** Although the project review mechanism for public construction in Taiwan is effective for monitoring progress, it lacks a check point mechanism similar to the one used by the Japanese government to evaluate all the phases of a construction project, from approval to completion. In the Japanese system, projects that do not meet the evaluation criteria are evaluated by committees to determine whether they should continue. For projects considered for termination, many aspects must be considered, including the requirements, costs and benefits, the environment, and safety, so that contingency plans can be formulated in case termination actually occurs. Therefore, the termination concept used in Japan can serve as a reference when designing such mechanisms in Taiwan.
- (c) **Open and transparent assessment results** Under the premise of open and transparent disclosure, policy assessment guidelines and project assessment results are fully disclosed by Japanese governmental information platforms. This not only enables the transmission of experience and knowledge, but it also provides a reference for assessing new projects.

### 2.3. Organizational Process Reengineering for the Government

Government business processes are a structured continuous-time chain of processes used to provide public services and can be improved by applying the method and theory of business process reengineering for the analysis and redesign of government work processes and procedures [7,23]. Similarly, government process reengineering is the theory of enterprise reengineering applied to the public management field [24]. A decision support framework for infrastructure investment has been proposed to support decision makers in improving the quality of services [25]. Zhang and He [26] argued that government management is a dual process of business and information management and used the

process reengineering theory to investigate and analyze existing problems within the government management process [26,27]. Based on their findings, they proposed an information transfer model for government management processes. Their model used information process reengineering to improve government management efficiency.

Zhang and Liu [28] used knowledge management for government process reengineering. They proposed that creating and applying a knowledge management system increases the efficiency of government process reengineering, elevates feedback feasibility, enhances organizational values, and rationalizes procedures. Moreover, by combining conventional processes with innovative technology, techniques, and management, the reengineering process enables the government to achieve the desired efficiency and to obtain definite and effective feedback in new management environments.

Tong et al. [29] modified the basic framework of business process reengineering by merging government process reengineering with innovative concepts and information transfer techniques to develop a process model for the policy system. Their study of government processes indicated that reform was essential for innovation. By supplementing process reengineering and information technology transfer with government reform, government managers can substantially improve efficiency.

Li [30] proposed that, during the reengineering and organizational restructuring process, management should minimize or exclude non-essential activities, dissolve traditional departments, and compress, simplify, and integrate jobs to reduce the number of job categories. By applying these general rules, the government can substantially improve its management efficiency. In response to the lack of a unified, selectable model for government process reengineering, Wang et al. [23] introduced seven steps for improving management efficiency in the government: (a) conceptualizing and planning, (b) initiating reengineering options, (c) examining existing processes, (d) re-designing, (e) implementing new processes, (f) processing assessments, and (g) continuing improvements.

However, business process reengineering is required before government process reengineering. Before adopting a business management model for government management, government reforms and innovations have tended to focus on quality, cost, and customer satisfaction. Since then, reform objectives have begun focusing on achieving economical, highly efficient, and high-quality management [31,32] as well as improving government administration efficiency, enhancing service quality, elevating public satisfaction, reducing administrative costs, and promoting transparency [33]. To achieve these goals, Orosz et al. [34] introduced enterprise resource planning for government process reengineering and developed a dynamic procedural theory for improving management efficiency, managing process changes, and using time optimization to enhance resource usage.

In addition to using the process reengineering perspective to improve the administrative efficiency of government agencies, related studies have also shown that, despite process reengineering and innovation attempts, organization-oriented reforms have not been implemented in many government agencies [1]. These studies have proposed that, regardless of the type and size of business, all organizations require unique management approaches to ensure their functionality and performance [35–37]. Damanpour and Schneider [38] further demonstrated the lack of recent inter-government agency reforms by performing a questionnaire survey to characterize government innovation and reform. The survey results showed that innovation characteristics and the determination of managers are the key factors in organizational reform and innovation. Li and Yang [7] believed that government process reengineering, and e-government are interactive and complementary. The implementation cannot simply move existing businesses, offices, and procedures to the Internet. Instead, it should be an innovation of traditional working models, working methods, and working means.

Al-Fedgahi and Alnassar [39] proposed using organizational designs to study organizational process reengineering and introduced a complete organizational process system diagram to aid government agencies in improving operational efficiency. To enhance the development of organizational process systems for non-government public organizations,

Du et al. [40] considered the government management perspective by applying government agency innovation and reform methods to non-government public organizations. Gupta et al. [41,42] observed that the structured standard model of Enterprise Architecture can solve the challenges faced by the government. Therefore, they proposed the Zachman framework and architectural model (named the SauSam Model) of Government Process Reengineering to successfully roll out the e-Governance projects in the government sector successfully and used the SauSam Model to present a case study on Crop Loan Redemption project in India. Similarly, Lalendle et al. [6] developed a monitoring and evaluation (M&E) framework for sustainability assessment in the transport sector of South Africa.

Although these studies provided substantive references and proposed new methodologies, they required a review before inclusion in the guidelines developed in this study because they involved different cultures, legislations, and norms. Therefore, this study applied a qualitative research method widely used in the literature and integrated the process reengineering concept to formulate SOPs that could be used as a reference for government agencies. A cyclic review flowchart for public construction, a checklist for the agency in charge, and a competent authority review checklist for relevant departments were also developed to facilitate the implementation of the assessment mechanism. Hence, the contributions of this study include constructive ideas and highlight the lessons learnt from the experiences of Taiwan public service works in urban development and management.

### 3. Research Methodology

#### 3.1. Literature Analysis

The data analysis in this study included static information such as domestic and foreign government publications, books, academic journals, dissertations, and websites of official agencies. The research content mainly included relevant assessment systems, initiation and withdrawal mechanisms, and current practices in mid- to long-term public construction projects in Taiwan. This study considered Taiwan's current regulations and revision norms and suggested that the performance evaluation in the case analysis should take the economy, the environment, and the society into account simultaneously. Meanwhile, the economy, the society and the environment are the three pillars of sustainability as well as the decision-making tools for evaluating and improving project performance [42,43]. Therefore, the criteria for evaluating national, social, economic, and environmental conditions were then slightly adjusted for use in the current Taiwan system. Finally, the results were compiled and evaluated for use as a reference when reviewing and developing subsequent case studies, interviews, and project implementation systems.

#### 3.2. In-Depth Interviews

The function of in-depth interviews is to obtain a deep and solid understanding of the interviewees. Therefore, depth is a more important criterion than breadth [44]. According to Wiess [45], the observations of some interviewees who profoundly understand the considered phenomena could provide more information than the observations of hundreds of others. After reviewing the basic literature and performing a preliminary analysis, the researchers performed in-depth interviews with competent authorities in agencies responsible for reviewing domestic projects in public construction, transportation, hydraulic engineering, and flood control. This study conducted four in-depth interviews, including a member of the research committee from The Control Yuan, three senior specialists, three section chiefs from the Council for Economic Planning and Development, a section chief from the Water Resources Agency, and a senior specialist from the Ministry of Transportation and Communications. The objective of these interviews was to identify the obstacles that these agencies encounter when promoting transportation, hydraulic engineering, and flood control projects, the challenges presented by the systems, and the methods used to resolve the problems. During the interview process, the competent authorities and review agency officials for the case projects offered their personal experiences in addressing

these issues and their personal perspectives, which were used for reference in further case analysis and system designs.

### 3.3. Case Analysis

A case analysis, or case study, is a research design for analyzing the specific and complete morphology of events within a limited time. In addition to providing definite evidence to support abstract theories, this design provides insight into specific units as the basis for cross-level inferences [46,47]. Therefore, based on the foundation established by the literature review and the in-depth interviews with competent authorities and review agency officials, this study analyzed the background, planning, review processes, current implementation status, implementation difficulties, project objectives, and realized the benefits of projects to identify the causes of project failure regarding unsuccessful initiation prevention or withdrawal. The management methods and strategies adopted by the agencies in charge, the competent authorities, and the review agencies were obtained concurrently to provide references for amending future systems.

To make the proposed SOPs feasible in the construction of an information platform, this study analyzed domestic and foreign regulations and review mechanisms. The studied cases were selected on the basis of the proportion of the implementation budget of major economic development projects, including transportation facilities, water conservancy and flood control facilities, environmental protection facilities, energy facilities, and cultural facilities. Specifically, this study analyzed transportation facilities (Kaohsiung light rail transit), water conservancy, and flood control (KaoPing Great Lakes Project), environmental protection facilities (garbage resource recovery/incineration plant), energy facilities (Xibao Hydropower Station), and cultural facilities (local cultural centers) in Taiwan. In other countries, we investigated the highways in Indiana, the drainage system in Rotterdam, the hydroelectric power plant in the East Kent Canal in India, the Chongqing power plant, the urban development of Helsinki, the 3C road corridor plan in the United States, the No. 56 Kawasaki to Uchiko Project in Japan, and the M6 J32 southbound expansion project in Britain.

### 3.4. Theory of Process Reengineering

Li [7] proposed that government operation processes can be reengineered by applying the methods and theory of business process reengineering (BPR). The BPR theory was developed by Hammer [48] to transform existing operations procedures in companies since most cannot thoroughly reform their old habits. Hammer and Champy [32] further applied BPR in a systematic evaluation process for reviewing and radically redesigning workflows, which achieved dramatic changes in quality, cost, service, and performance. The steps for diagnosing and improving the administration process are (a) identify processes to be revised, (b) examine processes, (c) re-design processes, and (d) implement new processes.

### 3.5. Focus Group Interviews

A focus group interview is a carefully planned series of discussions with a selected group under specified conditions. The goal of the interviews is to understand the feelings and opinions of professionals regarding certain topics, products, or services [49]. After the literature review, this study performed in-depth interviews and a case analysis before drafting the SOPs for project initiation and execution as well as the relevant supporting methods for developing feasible operating procedures, provisions, and relevant measures. This study conducted focus group interviews. Scholars and experts (i.e., Professors of National Taiwan University, National Central University, Tamkang University, and Kainan University) were invited to discuss and review the formulated standards and procedures. The objective was to apply the ideas and suggestions resulting from the study to ensure that their implementation was practical and feasible.

#### 4. Assessment Mechanism for Project Initiation, Withdrawal, and Standard Operating Procedures

Based on the literature review, the current system analysis, expert interviews, and the theory of BPR, this study reengineered the SOPs, the review process, the checklists, and the review checklists for compiling and reviewing project data. These assessment mechanisms are described below.

##### 4.1. Project Conceptualization Stage

The analysis in this study indicated that the agency in charge at this stage should organize a team for reviewing and implementing core public infrastructure (CPI). The team should investigate and analyze project requirements and should explicitly define the criteria required for the projects. A report should then be written and submitted to the competent authority. The competent authority should establish a mechanism for assessing CPI projects exceeding TWD 1 billion. Only after a review by the competent authority may the agency in charge proceed to the feasibility evaluation stage, whereby the focus is to ensure that the case project requirement evaluation meets the standard requirements. Figure 1 shows a conceptualization stage process diagram of the reengineering process after integrating the project conceptualization processes and operation procedures.

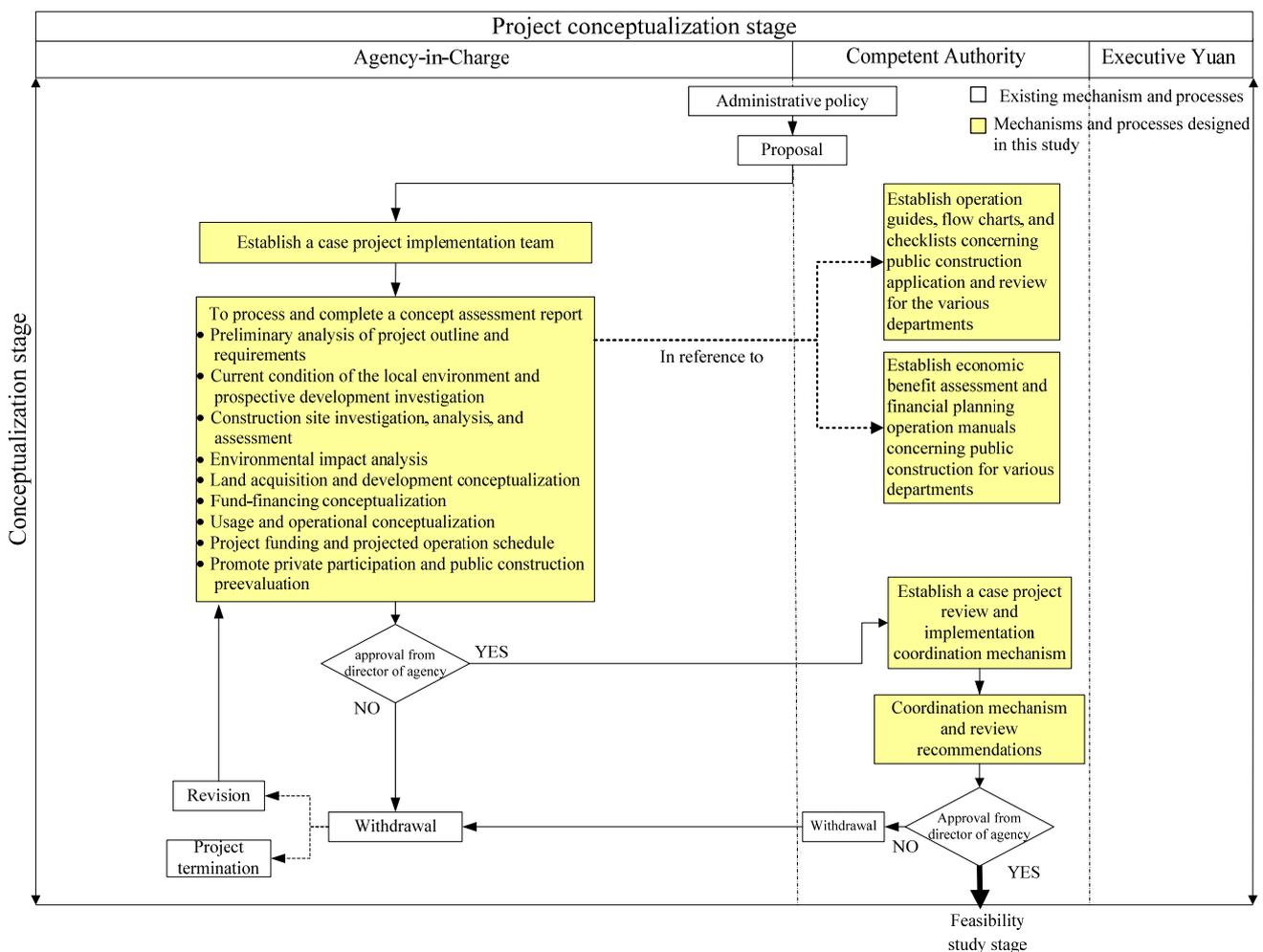


Figure 1. Flow chart of the project conceptualization stage.

##### 4.2. Project Feasibility Stage

At this stage, the agency in charge should perform feasibility studies of matters related to the further implementation of the project. For example, the agency in charge

should determine whether the projects meet the related requirements and whether they are financially feasible. The agency in charge should also impartially analyze the environmental impact of the project. An environmental impact statement should then be produced and submitted to the Taiwan Environmental Protection Administration (EPA) for review. After integrating the processing and operating procedures for the project feasibility stage, this study revised the feasibility stage process diagram as shown in Figure 2.

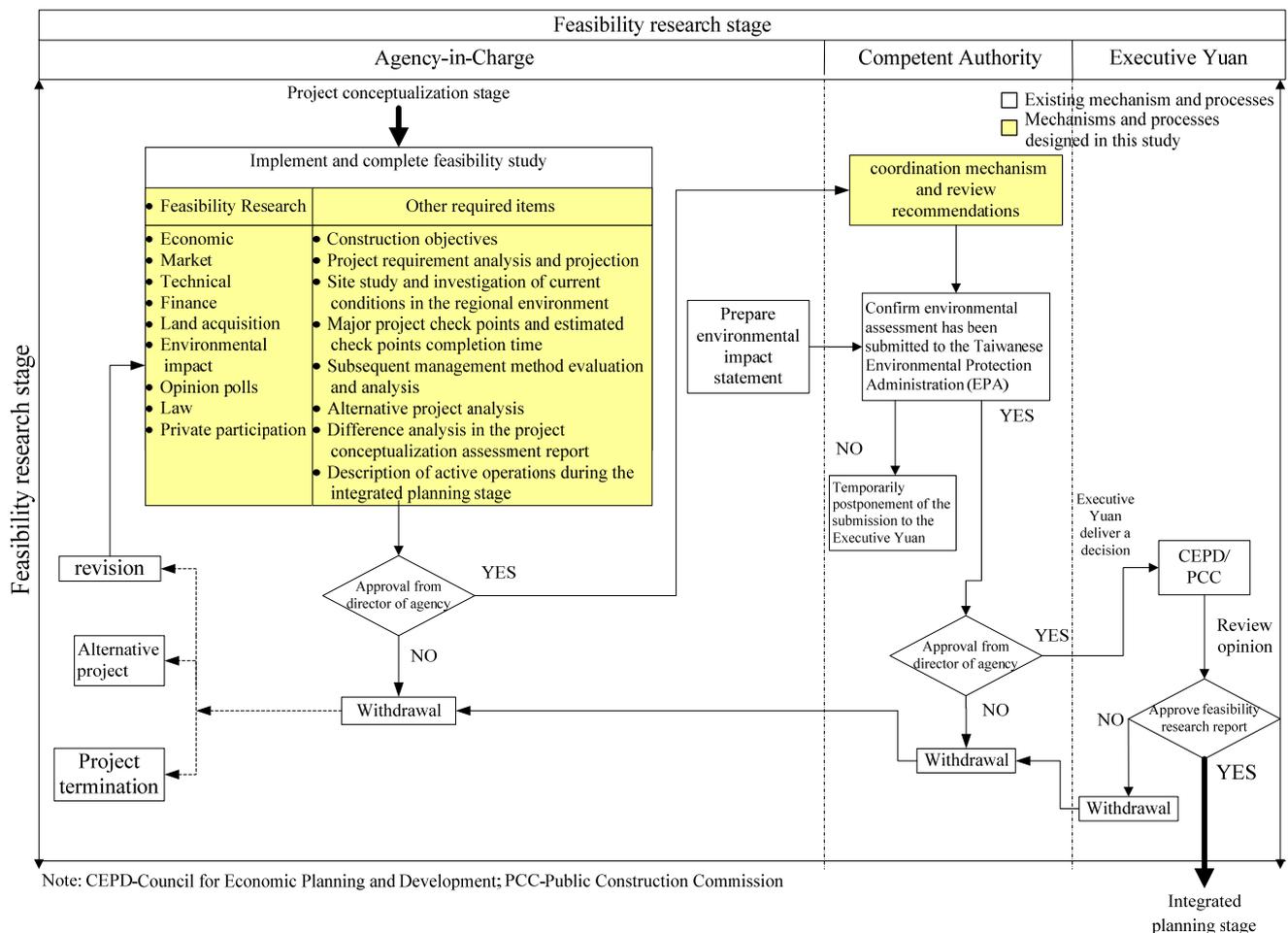


Figure 2. Flowchart of the feasibility research stage.

### 4.3. Integrated Project Planning Stage

When the case project enters the integrated planning stage, the agency in charge should consider the feasibility study results when drafting relevant plans, i.e., plans for land acquisition. When reviewing the integrated planning report submitted by the agency in charge, the competent authority must carefully confirm that the project meets the stipulated financial and environmental requirements. The competent authority must also ensure that the land acquisition portion of the project is reasonable and practicable and must perform inter-project appraisals to prioritize the projects according to benefit and demand. Figure 3 plots the comprehensive planning stage process after its integration with the operating procedures.

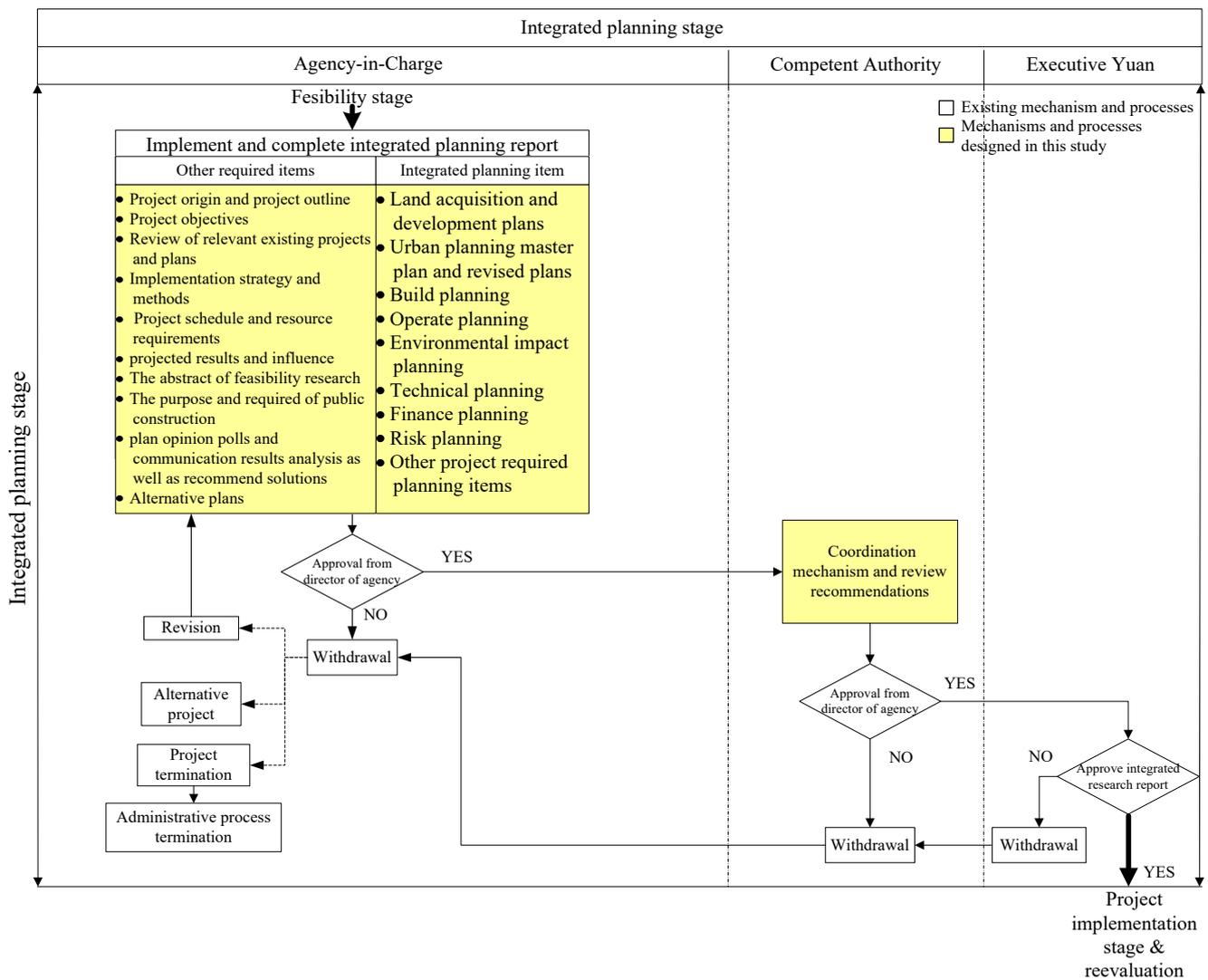


Figure 3. Flowchart of the integrated planning stage.

## 5. Reevaluation and Relevant Operating Procedure

### 5.1. Reevaluation Mechanism

To provide specific recommendations during the reevaluations, this study adapted the Japanese system and further divided the project implementation into two stages: (1) pre-construction reevaluation and (2) during-construction reevaluation. Here, “construction” is defined as a project in which the environmental impact assessment and land acquisition operations have already been completed. When performing the pre-construction reevaluation, the agency in charge of the case project must ensure that the five dimensions (i.e., demands, finance, environmental impact, land acquisition, and implementation performance) meet the standard requirements. Table 1 shows the standard requirements. This will enable the case project to continue, to be revised, or to be terminated based on the original plan. Table 2 shows the pre-construction reevaluation recommendation model.

**Table 1.** Five dimensions evaluated in the pre-construction and post-construction stages.

Dimension	Project Implementation Stage	
	Pre-Construction	Post-Construction
Demands	⊙	×
Finance	⊙	⊙
Environmental impact	⊙	×
Land acquisition	⊙	×
Implementation performance	⊙	⊙

⊙: Consideration required; ×: Consideration not required.

**Table 2.** Construction reevaluation recommendation model before project implementation.

Reevaluation Recommendations	Evaluation Dimensions				
	Demands	Finance	Environmental Impact	Land Acquisition	Implementation Performance
Continue project	⊙	⊙	Any two operations meet the project requirements		
Revise project	⊙	⊙	Any operation meets the project requirements		
Terminate project	No operation meets the project requirements				

⊙ Meeting project requirements.

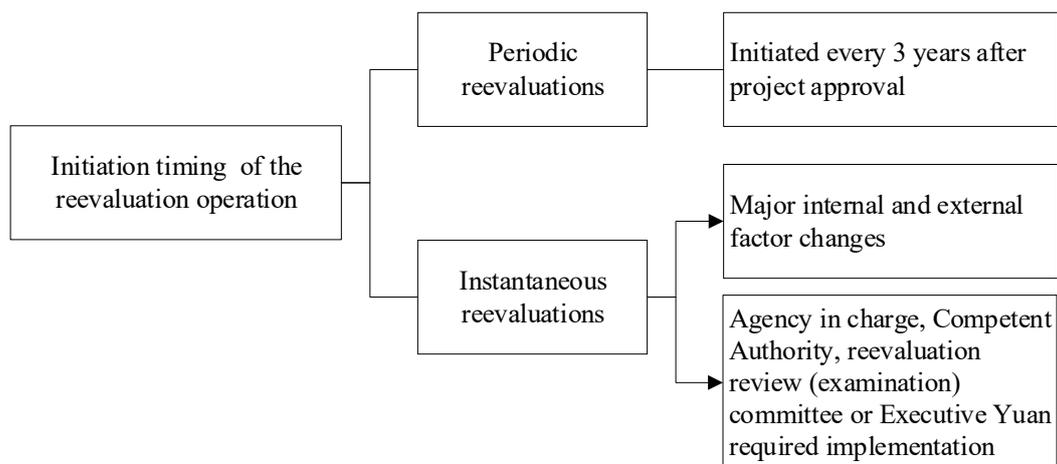
For a during-construction reevaluation, the agency in charge must consider only two of the five project-level dimensions (i.e., finance and implementation performance) because the environmental impact assessment and land acquisition will have already been completed at the construction stage. By the time the case project enters the implementation stage, significant resources have already been invested to promote the project; therefore, a demand review is no longer required. Table 3 shows the during-construction reevaluation decision model.

**Table 3.** Construction reevaluation recommendation model during project implementation.

Reevaluation Recommendations	Evaluation Dimensions	
	Finance	Implementation Performance
Continue project	All operations meet the project requirements	
Revise project	One operation does not meet the project requirements	
Terminate project	No operation meets the project requirements	

### 5.2. Initiation Timing and Procedure of the Reevaluation

The initiation time of the reevaluation operation is divided into periodic and instantaneous initiation. In periodic initiation, the objective is to use the reevaluation mechanism to determine how the subjective and objective status and changes in the internal and external factors of the project affect the project itself during the project implementation stage. This study further proposed the instantaneous initiation model; the initiation times are shown in Figure 4.



**Figure 4.** Project reevaluation initiation types.

After considering the project implementation stage and the project revision and termination mechanism, this study formulated a reevaluation process model for governmental agencies (Figure 5).

- (a) **Agency in charge** The review and implementation team for CPI projects under the agency in charge is responsible for executing the reevaluation operation. The agency in charge must consider all five dimensions during a reevaluation (i.e., finance, environmental impact assessment, land acquisition, implementation prior to making reevaluation recommendations, and submitting recommendations to the competent authority). Their range of work is based on integrated planning; they only reevaluate operations with identifiable discrepancies. The reevaluation results should then be reviewed by the competent authority and by the Executive Yuan.
- (b) **Competent Authority** The competent authority should establish a review and an implementation coordination mechanism to assess the reevaluation report submitted by the agency in charge and to make inter-project appraisals that meet the standards set by the competent authority. The appraisal results and the reevaluation reports are then jointly submitted to the Executive Yuan for assessment. When reviewing the reevaluation report, if the competent authority observes that the evaluation performed by the agency-in-charge is not neutral and objective, or if the evaluation content is clearly false or other faults are identified, the competent authority should return the reevaluation report and command the agency in charge to re-implement the process before resubmitting the report.
- (c) **Reevaluation conclusion by the Executive Yuan** After receiving the case project reevaluation report from the competent authority, the Executive Yuan makes the final decision regarding whether the case project should continue, and the competent authority and the agency in charge must comply accordingly. When reviewing the reevaluation report submitted by the competent authority, the Executive Yuan is required to return the reevaluation report and command the agency in charge or the competent authority to re-implement the process if any of the following flaws are detected: (i) the agency in charge did not honestly execute the reevaluation; (ii) the evaluation content is clearly false; (iii) other faults are identified; or (iv) the competent authority did not thoroughly perform the review.

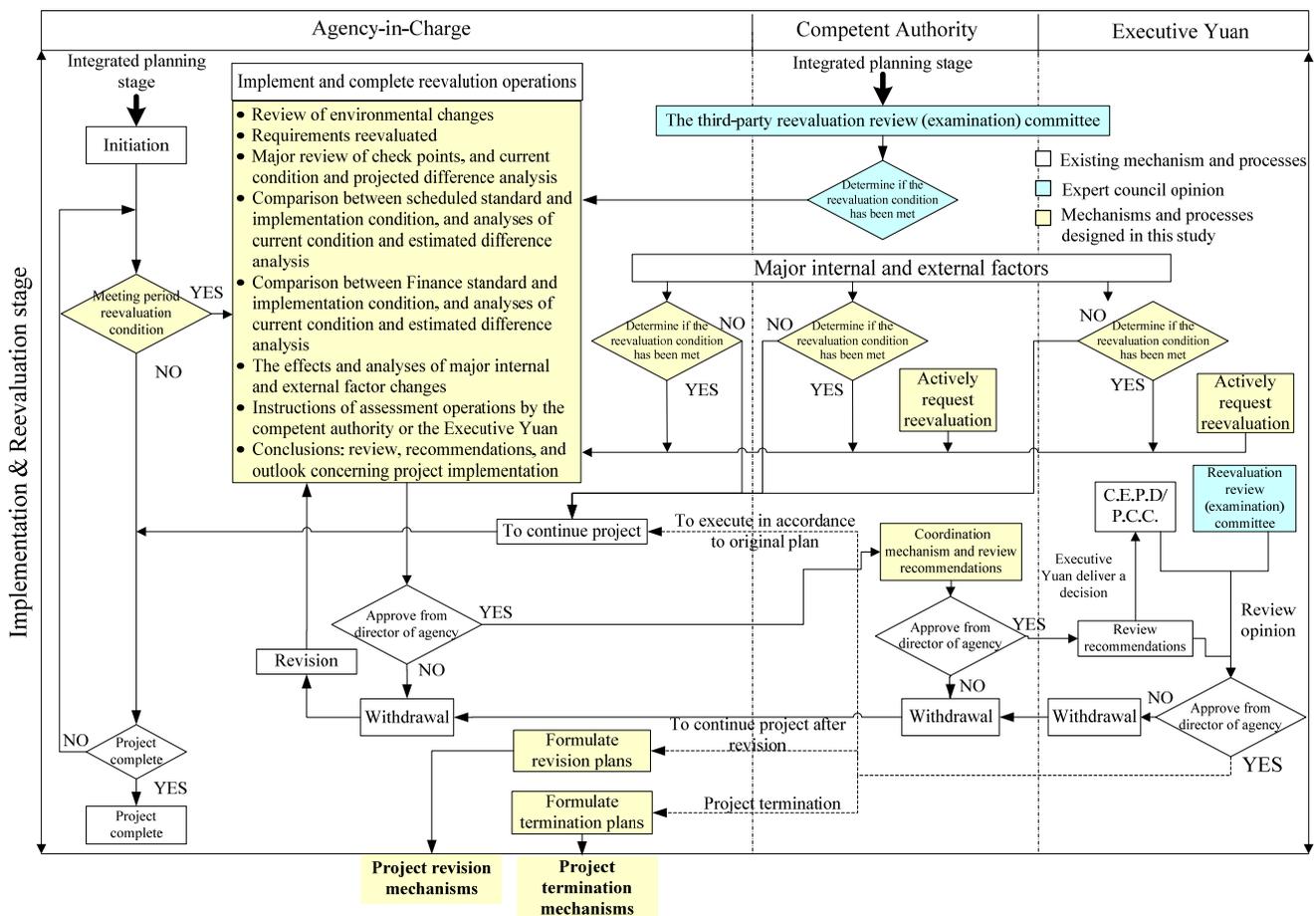
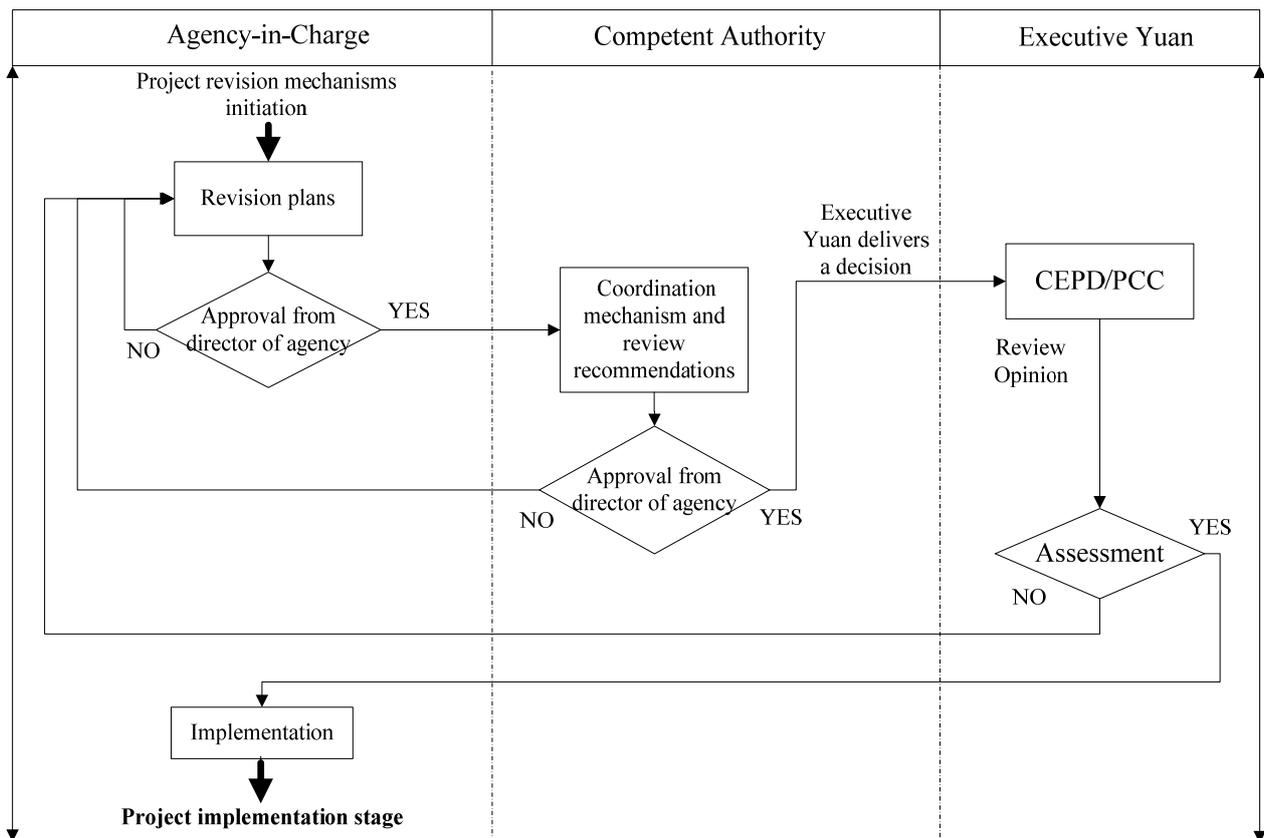


Figure 5. Flowchart of project implementation and reevaluation.

### 5.3. Project Revision Procedure in the Reevaluation Operation

If a reevaluation during the case project implementation stage concludes that the plan should be revised, the agency in charge must promptly develop a revised plan and submit it to the competent authority and the Executive Yuan before further implementation. If the agency in charge obtains a reevaluation recommendation advising project termination but receives a revision conclusion from the Executive Yuan, the agency in charge must still develop a revision plan and an integrated proposal and submit them to the competent authority and the Executive Yuan before further implementation. The related submission process should be performed according to the integrated planning provisions.

After the reevaluation process, the agency in charge must promptly formulate a revised plan for case projects approved for continuation after revision. The revised project should focus on the issues identified during the reevaluation procedure and should provide further analysis and explanations; the process must also comply with the review guidelines for mid- to long-term case projects concerning the project revision content and should follow the same procedure described above. Figure 6 shows the project revision procedure.



**Figure 6.** Flowchart of the project revision mechanism (when integrated planning is no longer required).

#### 5.4. Project Termination Procedure in the Reevaluation Operation

A project must be terminated if it meets the following criteria: (a) it is no longer deemed valuable; (b) it cannot achieve the goal despite revisions; or (c) the Executive Yuan opts to terminate the project. The project termination procedure (Figure 7) initiated by the agency in charge comprises the following main steps: project suspension; current situation check; termination plan development and subsequent submission; implementation after project termination is approved; and project closure. The recommended operating procedures and processes are described below.

The first step of project termination is project suspension, which prevents further investment of resources. It also prepares the agency in charge for a current condition inventory check. After the termination of the case project is confirmed, the case project should be halted immediately, regardless of the status of the various work assignments. For projects in which termination has been confirmed, the agency in charge must decide whether to use the remaining investment resources. If sudden termination of a project poses a potential threat to public safety or is detrimental to the national interest, the termination procedure must be gradual. The agency in charge should state the reasons prohibiting sudden suspension during the current situation check stage and must determine the soonest and most appropriate suspension point.

After the agency in charge issues an order to suspend the project, the current situation check may be initiated to check the project implementation status when the project is suspended. After the status is checked, the agency in charge develops the termination plan, which must include two reports: the project termination analysis and the check report.

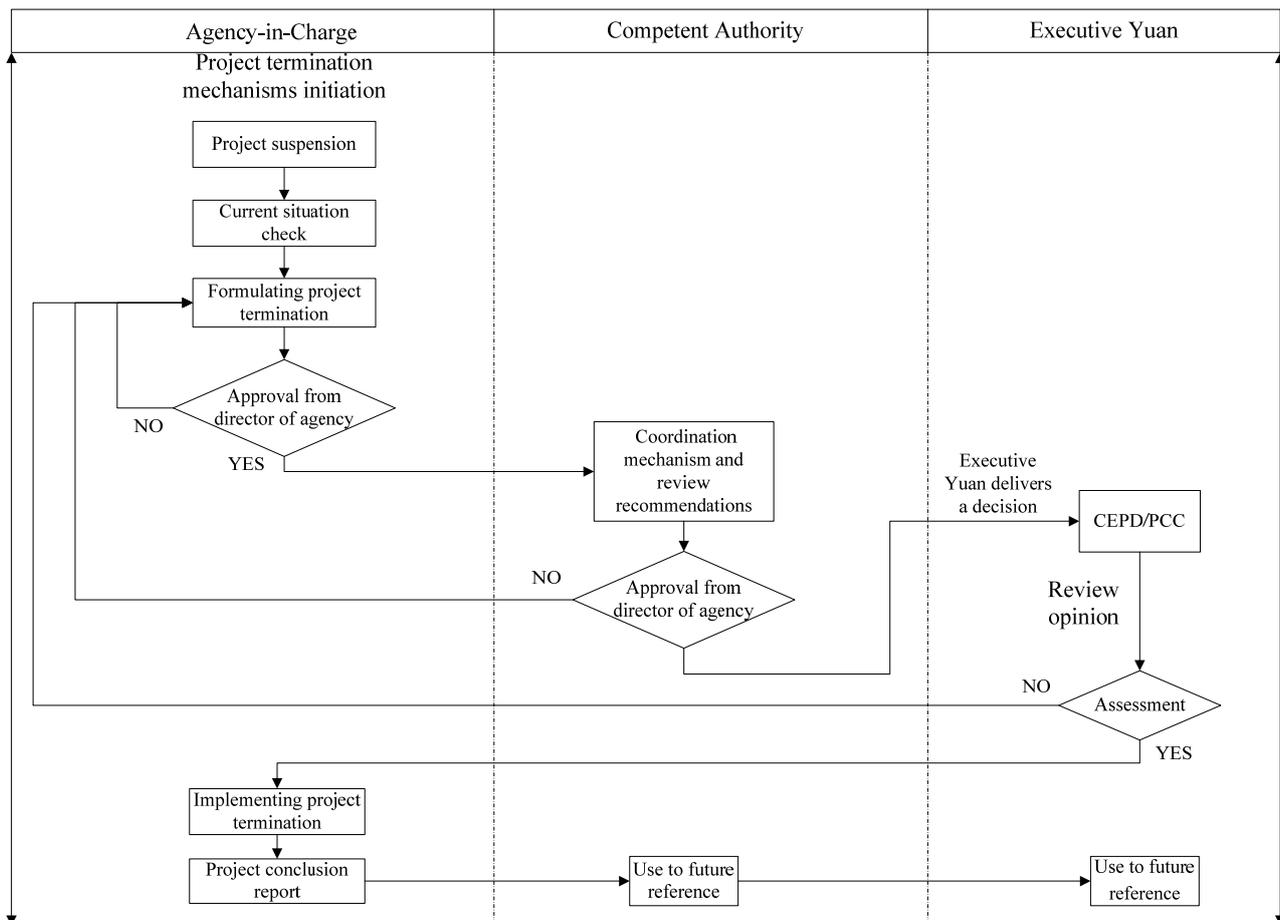


Figure 7. Flowchart of the project termination mechanism.

After completing the current situation check for the project, the agency in charge should develop a project termination assessment report based on the check results. This step occurs after confirmation of the project termination order and the completion of the check. This determines the original project benefits and the costs of project termination. It also establishes the plan direction and the project termination procedures.

Additionally, project termination is divided into three categories:

- (1) Project suspension: The original project can be suspended if the government has financial difficulties. The agency in charge develops the conditions under which the original project can be reinitiated and periodically checks these conditions. The agency in charge also manages the completed portion of the project.
- (2) Project termination: If changing circumstances make the implementation of the original project unnecessary or impossible, the agency in charge must properly manage and use the completed portion of the project.
- (3) Project transformation: Despite failing to achieve the original objectives, the terminated case project may still have potential to meet other demands or achieve various objectives if modified. In this case, transformation of the project should be considered.

Because of the many problems caused by project termination, this study further summarized the five related operations after the projects are terminated: (a) labor services, (b) construction procurement, (c) land acquisition, (d) environmental assessment, and (e) financing. For project termination, the following management method is recommended.

- (a) Labor services During the project implementation stage, many labor services must be contracted by the agency in charge to outside professional agencies. The most common services include environmental impact assessment, land use change, construction planning and design, and project management. Most services are labor-related. Based

on the four stages of the government procurement process (i.e., unawarded, awarded but not finalized by a signed contract, contract signed and project in progress, and contract fully executed), adaptive strategies are proposed for the termination of project labor service. Table 4 shows the proposed adaptive strategies.

- (b) Construction procurement Physical construction operations are classified as government procurement for construction, such as road construction, pipeline installation, and building construction. This work is often costly and cannot be terminated once construction is initiated. The agency in charge must carefully consider factors such as safety and previous investments. Table 5 shows the recommended adaptive strategies for terminating construction procurement.
- (c) Land acquisition operations Land acquisition operations are divided into two stages. (1) The first stage is the acquisition of land-use rights. Land use for public facilities requires expropriation or acquisition applications, and land use for non-public facilities requires a letter of consent to using the land or a letter of authorization consistent with the case project objectives. (2) The second stage is land zoning changes. Each stage begins after the approval of the case projects and before project construction. To terminate a land acquisition, the adaptive strategies in Table 6 may be used.
- (d) Environmental impact assessment operations The general approach to conducting an environmental impact assessment operation is for the agency in charge to commission a professional organization (e.g., an engineering consultant firm) to perform further environmental monitoring operations. Since this approach resembles that for labor services, the relevant regulations for labor service termination described above are also used for project termination. For case projects already in the environmental impact assessment process, the agency in charge should immediately notify the environmental authorities of a project termination so that the environmental impact assessment can be stopped. For case projects in which approval has already been received from environmental authorities, the agency in charge should notify the environmental authorities of a termination so that the environmental impact assessment results can be revoked.
- (e) Funding–financing operation If budgets are being prepared for the terminated case project, budget preparation must immediately stop. However, the budget received for the case project at the time of termination should be maintained until final approval of the termination. The amount of money required to terminate the project is reserved, and the remainder is returned. All related operations should comply with government budget acts.

**Table 4.** Recommendations for managing labor service contracts for terminated projects.

Contract Execution Stage	Management Recommendations
Contract not awarded	Terminate the bidding process
Contract awarded but not signed	Terminate the bidding process according to relevant provisions
Contract signed and project underway	a. The contract subjects have reusable value and must be fulfilled according to the original plan
	b. Parts of the contract subjects have reusable value or can satisfy other requirements; contract should be amended according to contract provisions
	c. The contract subjects do not have reusable value and should be terminated according to contract provisions
Contract fully executed	Relevant contract execution data is archived according to provisions

**Table 5.** Management recommendations for physical construction contracts for terminated projects.

Contract Execution Stage	Management Recommendations
Contract not awarded	Terminate the bidding process
Contract awarded but not signed	Terminate the bidding process according to relevant provisions
Contract signed and project underway	a. For operations that may proceed as originally planned upon project completion, operation strategies should be devised and introduced in the termination assessment report. Operation plans should also be devised and included in the termination plan. The two reports should be submitted to the appropriate unit for subsequent construction and operation.
	b. For operations that require supportive measures to operate or transform, further development strategies should be devised and included in the termination assessment report. The subsequent development plans should be devised and provided in the termination plan. Both reports should be approved by the responsible unit before further management.
	c. For operations that cannot be executed or transformed, a management model should be devised and included in the termination assessment report. Management plans should be devised and included in the termination plan.
	d. If the sudden termination of a project poses a potential threat to public safety or is detrimental to the national interest, the project should be terminated gradually.
	e. During project suspension, the agency in charge should properly manage the completed portion and the construction site, the construction equipment, and the raw materials to maintain public safety and to prevent damage to public and government assets.
	f. Revise or terminate in accordance with contract provisions.
Contract fully executed	a. For operations that may proceed as originally planned, operation strategies should be devised and provided in the termination assessment report. Operation plans should also be devised and provided in the termination plan. The two reports should be submitted to the appropriate unit for subsequent operation.
	b. For operations that require supportive measures to operate or transform, subsequent development strategies should be established and provided in the termination assessment report. Subsequent development plans should be established and provided in the termination plan.
	c. For operations that cannot be executed or transformed, a management model should be devised and included in the termination assessment report. Management plans should also be established and included in the termination plan.

**Table 6.** Management recommendations for land use in terminated projects.

Item	Management Recommendations
Expropriated land	a. Retain the land for other purposes
	b. Land not useful for other purposes should be sold, and the original landowner should have priority for purchasing the land
Letter of consent to use the land	Notify the landowner to revoke the letter of consent
Change in land use zone	a. May be retained if useful for other purposes
	b. For changed resolutions with a development deadline, the land automatically reverts to the original land use zone if the development permit has not been obtained
	c. Apply for rezoning to revert the land use to its original zone

## 6. Conclusions and Future Work

The objective of this study was to reengineer the government operations process by developing project initiation and withdrawal mechanisms for public infrastructure projects in Taiwan. Standard operating procedures for a suitable evaluation mechanism for project initiation and the withdrawal of Taiwan public construction projects were developed after analyzing relevant domestic norms, hosting interviews with associated ministry

members, and reviewing examples of foreign norms, methods, and cases. Moreover, the systematic approach in reengineering processes provides an exemplary model when establishing a three-tier governance mechanism for project assessment of core public infrastructure. This study contributes to the establishment of a re-evaluation mechanism, standard operating procedures, and supportive measures to potentially reduce the misuse and waste of national resources and to maximize the efficiency of resource use. The conclusions are summarized below.

- (a) Re-evaluation mechanism and supportive measures for project withdrawal provisions Currently, mid- to long-term plans in Taiwan are evaluated by a pre-project benefit assessment, during-project control and management, and post-project assessment and review. However, no re-evaluation review mechanisms or provisions have been established for governing the implementation of operations, conditions, procedures, and supportive measures. Additionally, although mid- to long-term case project compilation and review guidelines include provisions for governing project withdrawal and revision, the conditions, procedures, implementation operations, and supportive measures for project revision or termination are not explicitly defined. Therefore, an integrated operating procedure is urgently needed. By integrating relevant operation provisions, this study developed a standard review procedure, effective assessment procedures, a checklist, and a review checklist to serve as a reference for government agencies. Further, this study proposes a mechanism for establishing provisions, procedures, and operation checklists for re-evaluating public construction projects in Taiwan and for screening unsuccessful projects for potential termination.
- (b) The reference study with assessment and re-evaluation concepts The studied British and Japanese construction project mechanisms not only emphasize economic benefits, they also clearly identify the relevant concepts and assessment indicators for financial benefits, land acquisition, security, environmental impact, policy necessities, and other unquantifiable dimensions. Both the British and Japanese governments have stipulated a reference value for the social discount rate in the financial performance index, and the British government has also specified an appropriate analysis method for obtaining a risk assessment index. The assessment mechanisms in both the United Kingdom and Japan incorporate a feedback design for monitoring and reviewing project efficacy at all stages, from planning to completion. Reviews of the changes in the project conditions and the environment, risk, uncertainty, and deviations from the original targets are required at all stages, including the implementation stage. Under the premise of open and transparent disclosure, policy assessment guidelines and project assessment results are fully disclosed on government information platforms. This not only provides a source of education to others, but it also provides a reference for future project assessments. The basis of the reference applied in this study was the assessment concept used for project implementation in the United Kingdom and Japan, and the reevaluation concept used in Japan. However, the Japanese government has only adopted periodic reevaluations whereas this study not only developed periodic reevaluations, but also included an instantaneous reevaluation initiation mechanism.
- (c) Case validation and practical operation manuals After integrating foreign norms and combining process reengineering viewpoints, relevant domestic provisions, laws, and operation manuals, this study proposed SOPs, assessment procedures, checklists, and a checklist for reviewing all phases of a project, including conceptualization, a feasibility study, integrated planning, and implementation. This approach transformed the proposed domestic public construction compilation and review mechanism into a cyclic recurring practice. The innovative feedback process proposed in this study was applied in domestic cases to verify its effectiveness. The agency in charge operation checklist and competent authority operation review checklist were also revised to include an agency in charge reevaluation operation checklist and competent authority reevaluation review checklist for use by government agencies as references during

the subsequent promotion of related projects. By conceptualizing and implementing the reevaluation mechanism and supporting methods, this study provides a useful reference for government agencies when amending laws, establishing compilation and review (examination) agencies, and formulating practical operation manuals.

This study was limited to a plan-level policy evaluation, from initiation to execution, for a project scale exceeding TWD 1 billion. The study is also limited to mid- or long-term public infrastructure projects. The assessment mechanism is established from the perspective of government agencies. In future works, an ex-post project performance evaluation is needed to complement the total life-cycle assessment (LCA) for the public works and to use the proposed framework for case verification. Meanwhile, it can be used as a reference for the government to build an information platform for facilitating the LCA of public projects.

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